RESULTS OF INDOOR AIR QUALITY INVESTIGATION

NAVAL SEA SYSTEM COMMAND

WASHINGTON NAVY YARD

BUILDING 176

CONDUCTED FOR:

NAVSEA

OCTOBER 2001

ADVANCED ENVIRONMENTAL SERVICES, INC.

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EXECUTIVE SUMMARY

Naval Sea System Command (NAVSEA) issued a contract to Advanced Environmental Services, Inc. (AESI) for a baseline indoor air quality study at some of their buildings at the Navy Yard, Washington.

During the week of September 3-7, 2001, Dr. David Anderson of AESI toured the facilities and conducted preliminary baseline sampling. The facilities, for the most part, were recently remodeled and occupied by NAVSEA personnel, transferring in from Crystal City, Virginia. Some of these buildings were listed as historical sites.

Building 176 was occupied by NAVSEA personnel on the first floor, only, serving as office space. Other Navy personnel occupied floors 2 and 3, with NAVSEA renovating floor 4 and 5.

During the initial inspection of Building 176 and sampling conducted on September 5, 2001, visible mold was discovered on the West side of the First Floor by a Fire Water Closet. Upon opening the Closet, water was observed inside. Visible mold was on the inside as well as the outside, and ran approximately 6 feet or so to the South and an unknown distance to the North; the walls were blocked by filing cabinets.

A total of six (6) samples were collected inside the facility four (4) air samples and two (2) swab samples of visible mold. The air samples were collected for mold using both Petri dishes (for viable organisms) and Zefon™ Air-O-Cell cassettes for total, non-viable airborne organisms; in addition, a sample was collected for total Volatile Organic Chemicals (VOCs) in the air. The samples were sealed and shipped via Fed Ex to an outside microbiological lab. The preliminary results were received via fax in September, with the final results received via mail in October.

Outside the air results were found to be high at 3,987 Counts per Cubic Meter of Air for total spores and 982 Colony Forming Units per Cubic Meter of Air (CFU / M^3) of viable spores.

Air samples collected from inside Building 176 were lower than the outside air. The samples taken from the East side were reported to contain 360 Counts per Cubic Meter for Air-O-Cell Cassette method, and 100 CFU / M^3 for viable organisms. An Air-O-Cell cassette taken from the West side by the visible mold produced 280 Counts per Cubic Meter of Air; no *Stachybotrys* was found.

A sample for VOCs was also collected from the West side. Only three (3) organic compounds were identified – but at very low (micrograms of organic material per Cubic Meter of Air) concentrations; those were 2-propanol, acetone, and toluene.

In addition, two (2) bulk samples were collected using swabs. Both samples were reported by the lab to contain 5 - 25 % *Stachybotrys.* One sample was collected from the South Wall, and one was collected from the East Wall, inside the Fire Water closet.

A fax was sent to Mr. Michael Smith, COTR, with the preliminary data on September 16, 2001. It indicated the presence of *Stachybotrys* and suggested the area on the West side be isolated.

The Navy requested additional testing to determine if contamination levels had spread. A second trip and more extensive sampling was conducted during September 26 to 28, 2001.

On September 27, a total of 21 samples were collected in Building 176 – seventeen (17) air samples and four (4) swab samples. On the first floor, containment had been erected using polyethylene sheeting, and occupants moved out of their cubicles / offices, per the suggestion after preliminary lab results had been obtained.

The highest level in the air was found in the Fire Water closet, which was dry, at 947 Counts per Cubic Meter of Air including *Stachybotrys*; outside the Closet, but inside the Containment, the level was 387 Counts, also including *Stachybotrys*.

NAVSEA personnel were in the process of occupying renovated office spaces on the Fourth and Fifth floors.

Stachybotrys was contained, but had become airborne inside the containment. Various levels of mold were found throughout the remainder of the building, but all reported results were below the outside level and no further *Stachybotrys* was found in the air.

It appears that the mold and moisture levels are not within the guidelines currently used and *Stachybotrys* has been identified in the West section of the First Floor. Remediation is warranted. Following remediation, clearance sampling should be conducted by or under the direction of a Certified Industrial Hygienist prior to reconstruction to verify successful abatement.

The report is based on information available to us at this time. No other aspects if indoor air quality (IAQ) were examined. AESI reserves the right to revise, supplement, and otherwise amend our opinions and conclusions, if necessary and warranted by the discovery of new or additional information.

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Date Issued

INTRODUCTION, METHODOLOGIES, AND OBSERVATIONS

Naval Sea System Command (NAVSEA) issued a contract to Advanced Environmental Services, Inc. (AESI) for a baseline indoor air quality study at some of their buildings at the Navy Yard, Washington.

The purpose of the visit was to conduct a visual inspection of the interior, to collect airborne and bulk samples to establish a baseline for Indoor Air Quality measurements, to determine if a possible health risk was present and to recommend appropriate corrective actions.

The investigation was conducted in accordance with the recommendations and guidelines of the American Conference of Governmental Industrial Hygienists (ACGIH), the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), the Environmental Protection Agency (EPA), and established industry standards.

During the week of September 3-7, 2001, Dr. David Anderson of AESI toured the facilities and conducted preliminary baseline sampling with the assistance of the COTR, Michael Smith. The facilities, for the most part, were recently remodeled and occupied by NAVSEA personnel, transferring in from Crystal City, Virginia. For the purposes of this report, the building runs West to East, with the primary entrance on the East, and is five (5) stories tall.

NAVSEA personnel occupied building 176 on the First floor only, which was used for office space. Other Navy personnel occupied floors 2 and 3, with NAVSEA renovating floor 4 and 5.

Outside, the weather was sunny and in the low 80's. Inside, the air conditioner was on and the temperature was 71 degrees with a relative humidity of 58%. Visible mold was discovered on the Walls around the Fire Water Room on the West side; boxes along the far West wall, South of the door to the Room were also observed moldy; when moved from the wall, further mold was observed. Inside the Room, standing water and visible mold was observed. (Appendix D)

At the Southwest corner of this building, a Naval Captain was working at his cubicle. He indicated he did suffer from allergies and that several boxes of books along the wall were discovered to have mold.

Inside, six (6) samples were collected - two (2) Air-O-Cell Cassettes, one (1) Petri dish, one (1) VOC, and two (2) swabs.

Zefon™ Air-O-Cell cassettes are used for total, non-viable airborne organisms. (For specific locations, please refer to Appendix A). Air-O-Cell cassettes collect samples for total organisms – both living (viable) and non-living (non-viable). The sampling pumps had been calibrated prior to arrival using a rotameter. These samples provide information on total fungal colony Counts per Cubic Meter (Counts / M^3).

A Petri Dish sample was also collected at the same location as one of the Cassette samples. The A-6 bioaerosol monitor, used to collect samples onto the Petri dish, was disinfected on-site using isopropyl alcohol. The air-sampling pump had been calibrated prior to the visit for the type of collection media using a standard method – wet test meter.

The sample collected in the Petri, which contained Potato Dextrose Agar (PDA) media, which allows for both cultivation and differentiation of spores, i.e. "viable". Following incubation, the samples are analyzed via light microscopy at 600X magnification, and the data are reported in numbers of Colony Forming Units per Cubic Meter of air (CFU / M^3), as well as the specific genus types, such as *Aspergillus* and *Penicillium.* (Plates were shipped to the lab inside ice chests to minimize growth between collection and laboratory-controlled incubation).

In addition, two (2) bulk (swab) samples were also collected. The "swab" method uses a Sterile BBL Culture Swab collected over an approximately one hundred square centimeter surface area; the swab is placed into a plastic holder containing agar, sealed and labeled.

A sample for Volatile Organic Compounds (VOCs) was also collected. This sample used a 400 milliliter evacuated flask equipped with a flow-limiting orifice. Once activated, air was drawn into the prepared flask; following the sampling time, the flask was sealed. Upon arrival at the lab, the flask was purged and contents injected into a gas chromatograph equipped with a mass spectrometer; a total of sixty three (63) different organic compounds were analyzed for each VOC sample collected.

All samples were sealed and shipped via Fed-Ex to an outside, independent microbiological lab that specialized in identification and analyses of these types of samples; in addition, they also participate in an Environmental Microbiological Proficiency Analytical Testing (EMPAT) quality control program administered by the American Industrial Hygiene Association, designed for maximum quality and control. An affiliate lab that is Accredited by the American Industrial Hygiene Association analyzed the organic materials. Chain-of-Custody forms were maintained.

A Tramex moisture meter was used to measure moisture in the floors and walls. Table I can be used to assess the existing moisture findings. Excessive moisture was found in the Walls.

TABLE I. MOISTURE READINGS

Area / Room	Readings (%)	Location
Fire Water Room	60 – 100	West Wall, South of Door, floor to 2 feet
Fire Water Room	60 - 100	West Wall, North of Door, 3 feet
West Wall	15 - 60	West wall, to 6 feet from corner, up to 2 feet
Floor	100	In front of Door to Fire Water Room to 2 feet
West Wall	30 – 100	Towards the Southwest Corner, in Captain's Cubicle, to 1 foot above floor.

(**Note**: Normal moisture contents typically average eight (8) to twelve (12) %)

In addition, a TSI IAQ monitor was used to measure temperature, relative humidity, carbon monoxide (CO) and carbon dioxide (CO_2). The average temperature and relative humidity has already been mentioned. The average CO level was 2 parts per million (PPM), and the average CO_2 level was 656 PPM.

The preliminary results for the samples were received via fax, followed by mail. (Appendix B, sample numbers 1-6). A fax was sent to NAVSEA with the preliminary data on September 16, 2001. Containment along the West side of the First Floor was recommended. Following additional lab results reported later, which found more *Stachybotrys* in another building; the contract was modified to allow for a comprehensive survey with expedited results.

This second trip occurred September 26 to 28, 2001. Building 176 was monitored again on September 27. Outside, the weather was cloudy and 60 degrees; inside the temperature and humidity varied by floor. On that date the containment was noted to be installed floor to ceiling, approximately 5 to 6 feet from the outside wall, containing the existing cubicles. The Office on the Northwest Corner had been vacated. The Captain's office and boxes on the Southwest was vacant and all boxes had been moved (probably spreading mold spores).

A total of seventeen (17) air samples and four (4) swab samples were collected.

Outside, the airborne level was elevated at 2,080 Counts per Cubic Meter of Air.

First Floor
On the first floor, two (2) air samples inside the Containment were found to contain airborne *Stachybotrys* – one sample just inside the curtain in the Center and one sample collected from inside the Fire Water Room. The Room was now dry and caulk had been placed where the wall met the concrete attempting to contain the water. The walls were still excessively moist 6 inches above the floor on the Southwest side of the Room and along the West wall.

The sample collected outside the Fire Water Room, but inside the Containment revealed 387 Counts.

Three (3) air samples were collected outside the Containment on the West side. Office number 1951 at the Northwest Corner had 213 Counts. In the Center of the room just outside the Containment, the air sample results revealed 427 Counts. Another sample was collected outside Cubicle 1994 on the Southwest side, reported to be at 280 Counts.

On the East side, an air sample was also collected by 1910. This sample revealed 347 Counts.

Bulk Samples: Four (4) bulk samples of visible mold were collected using swabs inside the Containment in and around the Fire Water Room. All samples revealed the presence of *Stachybotrys*.

Second Floor
No visible mold was noted. The average temperature was 69 degrees and the relative humidity was 53 per cent. Three (3) air samples were collected. On the West side, the results were found to be 360 Counts. In the Center, the results were 507 Counts. The East Side revealed 480 Counts. CO was 1 PPM; CO_2 was 600. Several blocked ceiling vents were noted on the West side.

Third Floor
No visible mold was noted. Three (3) air samples were also collected. On the West side, the results were found to be 240 Counts. In the Center, the results were 293 Counts. The East Side (301) revealed 227 Counts. CO was 1-2 PPM; CO_2 was 1,100 PPM. Temperature was 72 degrees with relative humidity at 52 %; the air seemed more humid as well.

Fourth Floor
No visible mold was noted; NAVSEA members were in the process of moving into this floor. Two (2) air samples were collected. On the West side (4500), the results were found to be 227 Counts. In the Center (4547), the results were 53 Counts. CO was 1-2 PPM; CO_2 was 500 PPM. Temperature was 70 degrees with relative humidity at 43 %.

Fifth Floor
No visible mold was noted; this floor was also being or had recently been occupied. Two (2) air samples were collected. On the West side Break Room; the results were found to be 53 Counts. In the Telecom Room in the Center, the sample was reported to be 347 Counts. CO was 1 PPM; CO_2 was 500 PPM. Temperature was 69 degrees with relative humidity at 49 %.

RESULTS

Toxicological and Health Effects

Bioaerosols:

Bioaerosols include any biological agent, which becomes airborne. Bioaerosols may include pollens, animal dander, bacteria, as well as fungi. Because fungi are spore-bearing organisms, which are ideally suited for airborne transport, they often produce symptoms of discomfort among certain individuals.

Fungi originally were considered as a group of plants lacking any stems leaves or roots. Consequently, they were classified along with algae and the lichens. Fungi differed from those groups, however, in their lack of chlorophyll. Fungi exist as parasites (plant, animal and human pathogens) or as saprophytes (decomposers of non-living organic matter).

There are currently about 80,000 described species of fungi, both yeasts and molds, with probably more species awaiting discovery. Fungi are beneficial as food, as producers of antibiotics, as fermenting agents, as sources of drugs, as well as in many aspects of industry. Fungi are also well documented for their role in allergy.

Those fungi most responsible for causing allergy include species belonging to *Alternaria, Cladosporium, Aspergillus, Drechslera, Fusarium, Phoma, Epicoccum, Penicillium, Rhizopus, Mucor, Aureobasidiurn pullulans, Nigrospora, Scopulariopsis* and spores of rusts and smuts. *Cladosporium* is the most common fungus found in the air, followed by *Alternaria, Penicillium, Aspergillus, Fusarium, and Aureobasidium pullulans*. Clinically, the causative allergenic agents for most persons sensitive to fungi are *Cladosporium* and *Alternaria.*

Aspergillus, Penicillium, Rhizopus, Mucor, Fusarium and *Cladosporium* are examples of fungi that can produce a large number of spores. As they are present at all times in both the indoor and outdoor environments and are an important factor in the production of allergy in susceptible individuals.

Although fungi may grow and produce spores in the water and soil, dead organic debris is considered the main repository for aerobic fungi. Fungal spores will disperse from leaf litter, decaying plant material and other available organic substrata into the air and then fall onto vegetation where they may cause disease; are carried into homes and offices where they may cause moldy bathrooms and basements; and inhaled by humans and animals where they may cause toxic reactions, disease, an allergy, or other fungal disorders; fall onto leather, wood, or food, causing various mold damage; or fall back to or sail onto other supportive materials and repeat the cycle. In any case, fungi cannot produce their own food and therefore must find a source of organic matter in order to survive. High humidity is also necessary for fungal growth and spore germination.

It is important to note that airborne fungal spores must be viable to produce disease or to grow and germinate, but they <u>do not</u> have to be viable to produce allergenic effects in sensitive people. Although a bright sunny afternoon might substantially reduce the viability of fungal spores in the air, it will not bring relief to persons suffering from fungal allergy. There is some indication that the occupants of this residence may currently suffer from this allergic reaction.

Fungal spores are always present in the air, with rain and snow washing down most from the air, and the wind and sunshine causing an increase in the atmospheric distribution of spores. The number of airborne fungi is lowest during the winter months and highest during the summer and autumn months, when dead organic debris is more plentiful.

From the compilation of numerous data, the following distribution indicates the majority and frequency of fungal organisms typically isolated in indoor environments:

Organism	Per Cent
Cladosporium	100
Penicillium	91
Alternaria	87
Epicoccum	53
Aspergillus sp.	49
Aureobasidium	44
Drechslera	38
Acremonium	36
Fusarium	25
Aspergillus niger	19
Rhizopus	13

Possible health effects associated with fungi generally fall into one of three groups:

1. Allergic: sensitization and immune responses such as allergic rhinitis (hay fever), asthma, or hypersensitivity pneumonitis.
2. Infectious: growth of the fungus in or on the body, as with aspergillosis or histoplasmosis
3. Toxic: disruption of cellular function and interaction with DNA, as occurs with toxigenic effects, including aflatoxin-induced cancer.

Mycotoxins exert their effect on organisms in many ways including interference with cellular respiration, interference with carbohydrate and lipid metabolism, and direct binding with DNA and RNA. Several trichothecene mycotoxins are produced by *Stachybotrys*, and both *Aspergillus* and *Penicillium* can produce ocharatoxin A. (For detailed explanations, please refer to Appendix C).

Stachybotrys Health Effects

Stachybotrys atra (SA) can produce several toxic chemicals called trichothecene mycotoxins. These mycotoxins are known to be toxic to both humans and farm animals exposed to significant quantities. Initially the toxic effects of the mold were seen in farm animals that had eaten contaminated hay or grain. Farm workers also experienced health effects (dermatitis, blood and immune system disorders) from handling contaminated material. A recent evaluation of several tricothecenes by the International Agency for Research on Cancer (IARC) found no evidence that they cause cancer.

There have been only a few documented cases of health problems from indoor exposure to SA. In general, the intensity of exposure and health effects from SA in the indoor environment is much less severe than those, which were experienced by farm animals and workers.

If SA spores are released into the air, there is a potential for allergic, respiratory or immunologic symptoms to develop or become exacerbated. These conditions include: asthma, hypersensitivity pneumonitis, allergic rhinitis, dermatitis, sinusitis and conjunctivitis. It is thought that these diseases are mediated by an immune response to SA (or other environmental agents). Many of the related symptoms are non-specific, but debilitating, such as discomfort, inability to concentrate and fatigue. Presently, it is not known whether long-term indoor exposure to airborne SA increases the risk of certain chronic respiratory diseases. In one reported case of indoor exposure, residents experienced cold and flu symptoms, diarrhea, headaches, fatigue, rashes and other symptoms. These symptoms disappeared after all of the contaminated ductwork, insulation, and ceiling material was replaced.

Association between SA in buildings and health effects

Health risk cannot be predicted based simply on the presence of SA in building materials as indicated by sampling results. In order for humans to be exposed indoors, spores must be released into the air and inhaled. Also, it appears that the symptoms listed above are not likely to develop in all persons exposed at levels likely to be found in buildings. The attack rate

(percentage of persons who develop symptoms) is generally low. At the present time, "safe" (or "unsafe") exposure levels have not been established.

INTERPRETATIVE GUIDELINES

Previous research and test data have revealed that indoor airborne spore levels of 30 % to 70 % of the outdoor spore levels are normal, with the same general distribution of spore types. Filtered air, air-conditioned air, or air remote from outside sources may average 5 to 15 % of the outside air at the time of sampling. Based on these guidelines, a residence with open doors and windows and heavy foot traffic may average 135 % of the outdoor level while a high rise office building with little air exchange may average 2 %. In addition, dusty interiors may exceed 100 % of the outdoors to some degree, but will still mirror the outdoor distribution of spore types. Dusty conditions were not noted.

Data collected by the National Institute for Occupational Safety and Health (NIOSH) collectively suggest that a level of 1,000 total colony-forming units (cfu) per cubic meter of air (M^3) may warrant investigation and remedial action. The American Conference of Governmental Industrial Hygienists (ACGIH) Committee on Bioaerosols suggests that the indoor air-borne fungal spore concentration, either in Colony Forming Units or as Countable organisms, should not exceed 30 % of the outside levels and that the indoor level should be qualitatively similar to the outside level; currently there is no TLV for mold. During the growing season, according to the OSHA Technical Manual, levels of outdoor airborne fungal spore levels can range from 1,000 to 100,000 cfu/M^3. This reference goes on to indicate that airborne contaminant indicators are 1,000 cfu/M^3, but that levels above this do not necessarily imply that the conditions are unsafe or hazardous. Risk management investigation should be initiated if the following species are confirmed to be present: *Stachybotrys, Aspergillus versicolor, Aspergillus flavus, Aspergillus fumigatus*, and / or *Fusarium moniforme.*

In April 2000, the Indoor Air Quality Association published "Recommended Guidelines for Indoor Environments" (IAQA 01-2000). In this document, their recommendation for culturable (viable) fungal bioaerosols was 300 cfu/M^3 for total and 50 cfu/M^3 for individual fungal spores, excluding *Cladosporium*.

Currently in the United States, IAQ issues are not regulated by a governmental agency. The ACGIH recommends gathering the best data possible and using knowledge, experience, expert opinion, logic, and common sense interpretation of current information. As stated earlier, microbiological species present in the indoor environment should be generally representative of the species in the outdoor environment to a significantly lesser degree. The indoor air samples should not contain specific identifiable pathogenic microbiological organisms.

AIR-O-CELL RESULTS:

The Air-O-Cell Cassette is a unique sampling device designed for the rapid collection and analysis of a wide range of airborne particles, including fungal spores. Air is drawn through a sampling cassette that contains a small, greased microscopic slide; the samples are analyzed via light microscopy at 600X magnification, with the entire slide (100% of the sample) being analyzed. The results are reported as **total**, meaning they include both viable (i.e., living) and non-viable fungal spores. This technique does not allow for the differentiation between *Aspergillus* and *Penicillium* spores, due to the small size. Small spherical fungal spores that cannot be identified and may include *Aspergillus*, *Penicillium*, and *Trichoderma* are grouped together as *Amerospores.* Additionally it does not allow for cultivation or speciation of spores. Typically the results from this collection and analysis method are higher than the Petri dish method, as <u>all</u> spores are collected and counted.

The sample results produced by the lab were received initially by fax and final copies via mail (Appendix B).

SEPTEMBER 5 AIR SAMPLES:
Outside the air results were found to be high at 3,987 Counts per Cubic Meter of Air for total spores – 34 % *Cladosporium*, 28 % *Amerospores*, 23 % *Ascospores*, 7 % *Aureobasidium* and four (4) other species at 5 % or less. From the viable (Petri dish) cultures, 982 Colony Forming Units per Cubic Meter of Air (CFU / M^3) of viable spores were incubated and identified. 80 % of this sample was *Cladosporium*, 13 % *Penicillium*, and 4 other species at 2 % each.

Air samples collected from inside were lower than the outside air. The samples taken from the East side by 1911 were reported to contain 360 Counts per Cubic Meter for Air-O-Cell Cassette method, and 100 CFU / M^3 for viable organisms. The Air-O-Cell analysis reported 59 % *Basidiospores*, 30 % *Ascospores*, 7 % *Amerospores*, and 4 % *Cladosporium*. The Petri dish cultures also collected by 1911 revealed 53 % *Cladosporium*, 33 % *Penicillium*, and 7 % each of *Aspergillus niger* and *Geotrichum*.

An Air-O-Cell cassette taken from the West side by 1955 and by the visible mold produced 280 Counts per Cubic Meter – 48 % *Basidiospores*, 29 % *Aspergillus / Penicillium*, 14 % *Ascospores*, and 10 % *Cladosporium*. No *Stachybotrys* was found.

A sample for VOCs was also collected from the West side by 1955. Only three (3) organic compounds were identified of the 63 tested for; those were 2-propanol, acetone, and toluene. These reported levels were in low concentrations (micrograms of organic material per Cubic Meter of Air).

BULK SAMPLES:
Two (2) bulk samples were collected using swabs. One sample was collected from the South Wall, and one was collected from the East Wall, inside the Fire Water closet. Both samples were reported by the lab to contain 5 - 25 % *Stachybotrys.* In addition, the sample taken from inside the closet also revealed 25 – 75 % *Aspergillus / Penicillium.*

SEPTEMBER 27 AIR SAMPLES:
A total of seventeen (17) air samples and four (4) swab samples were collected. No *Stachybotrys* was found outside the erected Containment; however, the *Stachybotrys* has become airborne inside the Containment.

Outside, the airborne level was elevated at 2,080 Counts per Cubic Meter of Air. This sample consisted of 40 % *Amerospores,* 26 % *Cladosporium*, 14 % *Ascospores*, 6 % each of *Basidiospores* and Smuts / *Myxomycetes*, and 5 other species at 3 % or less. No inside air samples meet or exceeded this level. This is the baseline, or standard other interior samples are compared to.

FIRST FLOOR
On the first floor, two (2) air samples inside the Containment were found to contain airborne *Stachybotrys* – one sample just inside the curtain in the Center and one sample collected from inside the Fire Pump Room. Not surprisingly, the highest airborne level found in Building 176 was in the Fire Pump Room at 947 Counts; this consisted of 65 % *Amerospores*, 14 % *Aspergillus / Penicillium*, 7 % each of *Ascospores* and *Stachybotrys*, and 3 other species at 3 % or less.

The sample collected outside the Fire Pump Room, but inside the Containment revealed 387 Counts – 72 % *Amerospores*, 7 % each of *Aspergillus / Penicillium* and *Stachybotrys*, and 4 other species at 3 % of the sample.

Three samples were collected outside the Containment on the West side. Office number 1951 at the Northwest Corner had 213 Counts in the air – 75 % *Amerospores* and 25 % *Aspergillus / Penicillium.* In the Center of the room just outside the Containment, the air sample results revealed 427 Counts – 72 % *Amerospores*, 12 % *Cladosporium*, 9 % *Aspergillus / Penicillium*,

and 6 % *Arthrinium*. Another sample was collected outside Cubicle 1994 on the Southwest side, reported to be at 280 Counts – 90 % *Amerospores* and 10 % *Aspergillus / Penicillium*.

On the East side, an air sample was also collected by Cubicle 1910. This sample revealed 347 Counts – 69 % *Amerospores*, 15 % *Aspergillus / Penicillium*, 8 % *Ascospores,* and 4 % each of *Alternaria* and *Cladosporium*.

BULK SAMPLES:

Four (4) bulk samples of visible mold were collected using swabs inside the Containment in and around the Fire Pump Room. The first sample was taken on the South Wall outside of the Fire Pump Room and revealed 5 – 25 % *Stachybotrys*. The second sample was taken outside, just to the South of the Door; it also revealed 5 – 25 % *Stachybotrys* and 1 – 5 % *Aspergillus / Penicillium*. The third sample was collected North of the Door behind metal filing cabinets; the results were 5 – 25 % *Stachybotrys*, 1 – 5 % of both *Amerospores* and *Stemphylium*. The fourth sample was collected inside the Fire Pump Room on the East Wall; 25 - 75 % *Stachybotrys* and 5 – 25 % *Aspergillus / Penicillium* were found. The room was visually dry when compared to the earlier visit and caulk had been placed at the bottom of the wall. Moisture checks revealed elevated moisture levels still existed.

SECOND FLOOR

No visible mold was noted. Three (3) air samples were collected. On the West side (2WNCIS), the results were found to be 360 Counts – 89 % *Amerospores* and 11 % *Cladosporium*. In the Center, the results were 507 Counts – 53 % *Amerospores,* 37 % *Aspergillus / Penicillium*, 8 % *Ascospores* and 3 % *Alternaria*. The East Side revealed 480 Counts - 64 % *Amerospores*, 28 % *Aspergillus / Penicillium* and three other species at 3 % each.

THIRD FLOOR

No visible mold was noted. Three (3) air samples were also collected. On the West side, the results were found to be 240 Counts – 94 % *Amerospores* and 6 % *Basidiospores*. In the Center (317) the results were 293 Counts – all *Amerospores*. The East Side (301) revealed 227 Counts - 94 % *Amerospores* and 6 % *Basidiospores*.

FOURTH FLOOR

No visible mold was noted; NAVSEA members were in the process of moving into this floor. Two (2) air samples were collected. On the West side (4500), the results were found to be 227 Counts – 65 % *Amerospores*, 24 % *Aspergillus / Penicillium*, and 6 % each of *Ascospores* and *Cladosporium*. In the Center (4547), the results were 53 Counts – 75 % *Amerospores* and 25 % *Basidiospores*.

FIFTH FLOOR

No visible mold was noted; this floor was also being or had recently been occupied. Two (2) air samples were collected. On the West side Break Room, the results were found to be 53 Counts – 75 % *Amerospores* and 25 % *Basidiospores*. In the Telecom Room in the Center, the sample was reported to be 347 Counts – 68 % Amerospores and 12 % *Cladosporium.*

CONCLUSIONS

The water leak on the First Floor caused damage and mold growth. Following the first visit, the Containment helped stop the migration and release of *Stachybotrys* spores into the rest of the Floor. The source of water was stopped or eliminated, at least during the tour on September 27. Remediation is mandated, primarily on the West side of the First floor and all items inside the Containment. The remainder of the building did not appear to have a significant issue with mold, but thorough cleaning of the First Floor is recommended. Ventilation could be improved on floors Two and Three.

RECOMMENDATIONS

Based on the evidence of mold growth, moisture, and damage, remediation is necessary. The following are guidelines to be followed by personnel trained in mold remediation, and not General Contractors. All remediation should be done by an organization familiar with mold abatement and conducted wearing the proper protective equipment. During the remediation, containment using 6-mil plastic sheeting and negative pressure using ventilation drawn through a HEPA filter prior to discharging should be utilized.

All contaminated sheetrock and wood must be removed using wet methods - misted with chlorine and water in order to minimize dust and spore generation.

Porous materials, such as joists, studs and plates, should be thoroughly examined for visible signs of fungal growth. If visual inspection reveals evidence of mold, the wooden structures and / or additional sheetrock may require removal. Deteriorated wood should be removed and replaced as part of the abatement effort. Once the contaminated materials are removed, visible signs of mold should be treated. ***Treatment*** consists of abrasive techniques (i.e., sanding, wire brushing, etc.) followed by HEPA vacuuming and application of a biocide, such as bleach and water, quaternary ammonium compounds, or other common biocides available for this purpose; gases such as chlorine or ozone should not be used.

DECONTAMINATION OF THE BUILDING:

West Side of the First Floor: The existing containment should remain in place. In addition, an air lock should be installed for entry and exit, and decontamination. Negative pressure, exhausted through HEPA air filters must be employed.

All sheetrock from the floor to at least six (6) feet up along the West wall and surrounding the Fire Water Closet should be removed and discarded, after bagging inside the containment. As the sheetrock is removed, additional mold may be discovered; if so, the sheetrock should be removed at least four (4) feet beyond the discovered mold. Insulation should be bagged and discarded. Deteriorated wood, if found, should be removed and replaced, or treated, depending on severity of damage, as part of the abatement effort. All sheetrock / insulation should be removed and discarded, including insulation on piping from ground to a minimum of six (6) feet. Abrasive techniques should be used with HEPA vacuuming for the affected wood structures and metal studs, if used, exposed piping, and inside the wall cavities. Exposed structural wood with visible mold growth or discoloration should treated as described above. All vinyl baseboards should be removed as the sheetrock is being removed. All piping and the inside walls of the Fire Water closet should be HEPA vacuumed and treated with biocides to 10 feet above the floor.

Floor and Carpeting:

All fabric materials should be removed and discarded a minimum of six (6) feet East from the West Wall and six (6) feet on either side of the Fire Water closet. It is anticipated that moisture has seeped under this raised floor and mold growth will be found. The bottoms of the flooring, and the slab should be treated as directed above.

Office Equipment and Personal Effects:

Inside Containment: "Hard" items such as metal, wood, glass, and plastic can be HEPA vacuumed and wiped down with a biocide. Other "soft" items such as boxes, chair coverings, should be discarded; contents if needed can be HEPA vacuumed. File cabinets on the East and North should be HEPA vacuumed (including contents), emptied, and the bottoms treated as above and for rust that was observed; alternatively they may be discarded after bagging. Outside Containment: Remaining cubicles and offices should have all items HEPA vacuumed, including personal items, window coverings, lamps, computers, partitions, and all remaining carpeting.

HVAC System: The entire system should be cleaned and disinfected following abatement according to guidelines published such as those issued by the North American Duct Cleaning Association (NADCA). Flexible ducts, if used, should be replaced. During this process, all vents throughout the building should be thoroughly cleaned or replaced.

HEPA air filters ("air scrubbers") should be run 3 to 5 days following abatement.

Fungi are found almost everywhere indoors as well as out. In order for mold to survive it needs a source of food and a source of moisture. Typically, moisture comes from water leaks or from the air. All sources of excessive water infiltration, such as plumbing leaks and roof leaks, must be identified and stopped prior to any successful abatement activity.

The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement, as well as the occupants.

It is the responsibility of the Contractors conducting remediation to ensure the methods enacted are adequate. The listed remediation methods are not meant to exclude other similarly effective methods. Any changes to the remediation methods listed in these guidelines, however, should be carefully considered prior to implementation.

The use of gaseous ozone or chlorine dioxide for remedial purposes is **not** recommended. Both compounds are highly toxic and contamination of occupied space may pose a health threat. Furthermore, the effectiveness of these treatments is unproven.

The following procedures are recommended for remediation / abatement:

- Containment of the affected area:
    1. Complete isolation of work area from non-affected spaces using plastic sheeting sealed with duct tape (including ventilation ducts / grills, fixtures, and any other openings)
    2. The use of an exhaust fan with a HEPA filter to generate negative pressure
    3. Airlocks and a decontamination area
- Personnel trained in the handling of hazardous materials equipped with the following types of Personal Protective Equipment (PPE):
    1. Respiratory protection (e.g., at a minimum, a N-95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended; alternatively full-face respirators with High Efficiency Particulate Air (HEPA) or P-100 filters may be used
    2. Disposable protective clothing covering both head and shoes
    3. Gloves
- Contaminated materials <u>that cannot be cleaned</u> should be removed from the building in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a detergent / biocide solution or HEPA vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. There are currently no special requirements for the disposal of moldy materials.
- The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and / or mop with a detergent / biocide solution and be visibly clean prior to the removal of isolation barriers.

These procedures are designed to minimize both exposure to the remediation crews and to minimize further exposure to the building and contents.

After remediation, additional visual inspection and clearance sampling conducted by or under the direction of a Certified Industrial Hygienist – not the abatement contractor – should be conducted to verify the results of the abatement prior to reconstruction and occupancy. Air scrubbers must be turned off 24 to 48 hours before clearance testing.

Appendix A

Sampling Locations

Sample Locations -
September 5, 2001

Sample Number	Sample Type	Location
1	Petri Dish	By 1911
2	Air-O-Cell	By 1911
3	Air-O-Cell	West side, by 1955
4	Swab	West side, by 1955, South
5	VOC	By 1955
6	Swab	Inside Fire Water Closet, Southeast Corner

Sample Locations-
September 27, 2001

Sample Number	Sample Type	Location
1	Air-O-Cell	By 1951 (West Side)
2	Air-O-Cell	Inside Containment
3	Air-O-Cell	Inside Fire Water Closet
4	Air-O-Cell	Outside Containment, Center
5	Air-O-Cell	Outside Containment, South, by 1944
6	Air-O-Cell	By 1910, East Side
7	Air-O-Cell	2W NCIS
8	Air-O-Cell	Second Floor, Center
9	Air-O-Cell	Second Floor, East
10	Air-O-Cell	Third Floor, West
11	Air-O-Cell	Third Floor, Center (317)
12	Air-O-Cell	Third Floor, East (301)
13	Air-O-Cell	Fourth Floor, West (4500)
14	Air-O-Cell	Fourth Floor, Center (4547)
15	Air-O-Cell	Fifth Floor, West (Break)
16	Air-O-Cell	Fifth Floor, Center (Telcom)
17	Air-O-Cell	Outside
18	Swab	West Wall, South of Fire Water Room
19	Swab	Wall, South of Entry Door
20	Swab	Wall, North of Entry Door
21	Swab	East Wall inside Fire Water Room.

Appendix B

Microbiological Result

And

Lab Data

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: Dr. David Anderson

AIHA Empat No. 102297

Viable Fungi Analysis - Air

Aerotech Method: A003

Lab Number: A-109-0683
Project Name: NYW
Project Number: 0880C(176)
Date Received: 09/07/01
Date Reported: 09/21/01

Lab Number	1			
Sample Identification	Petri 1911			
Date Incubated	09/07/2001			
Date Analyzed	09/20/2001			
Culture Media	Potato Dextrose (PDA)			
Volume (M^3)	0.1500			
		CFU/M^3		
	CFU	**Result**	**Detection Limit**	**%**
Viable Fungi 20-25°C	15	100	7	100
Acremonium				
Alternaria				
Aspergillus fumigatus				
Aspergillus niger	1	7	7	7
Aspergillus species Var. 1				
Aspergillus species Var. 2				
Aureobasidium				
Bipolaris				
Chaetomium				
Chrysosporium				
Cladosporium	8	53	7	53
Cunninghamella				
Curvularia				
Epicoccum				
Fusarium				
Geotrichum	1	7	7	7
Mucor				
Mycelia sterilia				
Paecilomyces				
Penicillium species Var. 1	5	33	7	33
Penicillium species Var. 2				
Phoma				
Rhizopus				
Sporotrichum				
Stachybotrys				
Stemphylium				
Trichoderma				
Ulocladium				
Yeast				
Notes:				

Prepared By:
CS Review:

Technical Review:
Final Review:

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Keller, TX 76248
Attn: Dr. David Anderson

AIHA Empat No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-0683
Project Name: NYW
Project Number: 0880C(176)
Date Received: 09/07/01
Date Reported: 09/11/01

Lab Number	2				3			
Sample Identification	0942 1911				0810 1955			
Volume (M^3)	0.0750				0.0750			
Date Analyzed	09/10/2001				09/10/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification				100% of Trace at 600X Magnification			
Debris Rating	1				1			
		Count/M^3				Count/M^3		
	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%
Mycelial Fragments	<1	<13	13	n/a	<1	<13	13	n/a
Pollen Count	<1	<13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	27	360	13	100	21	280	13	100
	Fungal Spore Identification				Fungal Spore Identification			
Alternaria								
Amerospores	2	27	13	7				
Arthrinium								
Ascospores	8	107	13	30	3	40	13	14
Aspergillus/Penicillium					6	80	13	29
Aureobasidium								
Basidiospores	16	213	13	59	10	133	13	48
Bipolaris/Dreschlera								
Botrytis								
Chaetomium								
Cladosporium	1	13	13	4	2	27	13	10
Curvularia								
Epicoccum								
Fusarium								
Nigrospora								
Oidium/Peronospora								
Pithomyces/Ulocladium								
Rusts								
Smuts/Myxomycetes								
Stachybotrys								
Stemphylium								
Torula								
Unidentified Conidia								
Notes:								

Prepared By:
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Technical Review:
Final Review:

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Keller, TX 76248
Attn: Dr. David Anderson

AIHA Empat No. 102297

Microscopic Screen and Fungi Identification

Aerotech Method: S001

Lab Number: A-109-0683
Project Name: NYW
Project Number: 0880C(176)
Date Received: 09/07/01
Date Reported: 09/11/01

Lab Number	**4**	**6**
Sample Identification	W Side South 1955	Inside Water Closet
Date Analyzed	09/10/2001	09/10/2001
	Results	**Results**
Mycelial Fragments	1-5%	5-25%
Fungal Spores	5-25%	25-75%
	Fungal Spore Identification	**Fungal Spore Identification**
Alternaria		
Amerospores		
Arthrinium		
Ascospores		
Aspergillus/Penicillium		25-75%
Aureobasidium		
Basidiospores		
Bipolaris/Dreschlera		
Botrytis		
Chaetomium		
Cladosporium		
Curvularia		
Epicoccum		
Fusarium		
Nigrospora		
Oidium/Peronospora		
Pithomyces/Ulocladium		
Rusts		
Smuts/Myxomycetes		
Stachybotrys	5-25%	5-25%
Stemphylium		
Torula		
Unidentified Conidia		
Notes:		

Prepared By:
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Lab Number: A-109-0683-05
Project ID: 0880C(170)
Sample ID: VOC By 1955
Sample Size: 400 mL Can
Date Received: 09/07/01
Date Analyzed: 09/07/01
Date Reported: 09/24/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Results			
Compound	**ppbv**	**µg/m³**	**Comments**
1,1,1-Trichloroethane	<2.0	<11.1	
1,1,2,2-Tetrachloroethane	<2.0	<14	
1,1,2-Trichloroethane	<2.0	<11.1	
1,1-Dichloroethane	<2.0	<8.2	
1,1-Dichloroethene	<2.0	<8.1	
1,2,4-Trichlorobenzene	<2.0	<15	
1,2,4-Trimethylbenzene	<2.0	<10	
1,2-Dibromoethane	<2.0	<15.6	
1,2-Dichlorobenzene	<2.0	<12.2	
1,2-Dichloroethane	<2.0	<8.2	
1,2-Dichloropropane	<2.0	<9.4	
1,3,5-Trimethylbenzene	<2.0	<10	
1,3-Butadiene	<2.0	<4.5	
1,3-Dichlorobenzene	<2.0	<12.2	
1,4-Dichlorobenzene	<2.0	<12.2	
1,4-Dioxane	<2.0	<7.3	
2,2,4-Trimethylpentane	<2.0	<9.5	
2-Butanone (MEK)	<2.0	<6	
2-Hexanone	<2.0	<8.3	
2-Propanol	9.2	22.9	
4-Ethyltoluene	<2.0	<8.8	
4-Methyl-2-pentanone	<4.0	<16.6	
Acetone	120	289.3	
Allyl chloride	<2.0	<6.4	
Benzene	<2.0	<6.5	
Benzyl chloride	<2.0	<10.6	
Bromodichloromethane	<2.0	<13.6	
Bromoethene(Vinyl Bromide)	<2.0	<8.9	
Bromoform	<2.0	<21	
Bromomethane	<2.0	<7.9	
Carbon disulfide	<2.0	<6.3	
Carbon tetrachloride	<2.0	<12.8	
Chlorobenzene	<2.0	<9.4	
Chloroethane	<2.0	<5.4	
Chloroform	<2.0	<9.9	
Chloromethane	<2.0	<4.2	
cis-1,2-Dichloroethene	<2.0	<8	
cis-1,3-Dichloropropene	<2.0	<9.2	
Cyclohexane	<2.0	<7	

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Keller, TX 76248
Attn: David Anderson

Lab Number: A-109-0683-05
Project ID: 0880C(176)
Sample ID: VOC By 1955
Sample Size: 400 mL Can
Date Received: 09/07/01
Date Analyzed: 09/07/01
Date Reported: 09/24/01

Volatile Organic Compounds (VOC's) - Air

EPA TO14A/TO15

Compound	Results		
	ppbv	$\mu g/m^3$	Comments
Dibromochloromethane	<2.0	<17.3	
Dichlorodifluoromethane(F-12)	<2.0	<10.1	
Dichlorotetrafluoroethane(F-11)	<2.0	<11.4	
Ethyl Acetate	<2.0	<7.3	
Ethylbenzene	<2.0	<8.8	
Heptane	<2.0	<8.3	
Hexachlorobutadiene	<2.0	<21.7	
Hexane	<2.0	<7.2	
m&p-Xylene	<4.0	<17.6	
Methyl tert-butyl ether	<4.0	<14.6	
Methylene chloride	<2.0	<7.1	
o-Xylene	<2.0	<8.8	
Propene (Propylene)	<2.0	<3.5	
Styrene	<2.0	<8.6	
Tetrachloroethene	<2.0	<13.8	
Tetrahydrofuran	<4.0	<12	
Toluene	3.0	11.5	
trans-1,2-Dichloroethene	<2.0	<8	
trans-1,3-Dichloropropene	<2.0	<9.2	
Trichloroethene	<2.0	<10.9	
Trichlorofluoromethane	<2.0	<11.4	
Trichlorotrifluoroethane	<2.0	<15.5	
Vinyl acetate	<2.0	<7.2	
Vinyl chloride	<2.0	<5.2	

Non-Target Analytes

Estimated Concentration (ppbv)	Number Of Compounds Detected
10-50	0
50-200	0
Greater than 200	0

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Attn: Dr. David Anderson

AIHA Empat No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-4269
Project Name: WNY-176
Project Number: 0981
Date Received: 09/29/01
Date Reported: 10/01/01

Lab Number	1				2				3			
Sample Identification	0801 1951 (W Side)				0899 Inside Curtain				0895 Fire Pump Op			
Volume (M^3)	0.0750				0.0750				0.0750			
Date Analyzed	09/30/2001				09/30/2001				09/30/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification				100% of Trace at 600X Magnification				100% of Trace at 600X Magnification			
Debris Rating	2				2				3			
	Total Count	Count/M^3 Result	Count/M^3 Detection Limit	%	Total Count	Count/M^3 Result	Count/M^3 Detection Limit	%	Total Count	Count/M^3 Result	Count/M^3 Detection Limit	%
Mycelial Fragments	2	27	13	n/a	<1	<13	13	n/a	1	13	13	n/a
Pollen Count	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	16	213	13	100	29	387	13	100	71	947	13	100
	Fungal Spore Identification				Fungal Spore Identification				Fungal Spore Identification			
Alternaria												
Amerospores	12	160	13	75	21	280	13	72	46	613	13	65
Arthrinium												
Ascospores									5	67	13	7
Aspergillus/Penicillium	4	53	13	25	2	27	13	7	10	133	13	14
Aureobasidium												
Basidiospores					1	13	13	3	1	13	13	1
Bipolaris/Dreschlera												
Botrytis												
Chaetomium					1	13	13	3	2	27	13	3
Cladosporium					1	13	13	3	2	27	13	3
Curvularia												
Epicoccum												
Fusarium												
Nigrospora												
Oidium/Peronospora												
Pithomyces/Ulocladium												
Rusts												
Smuts/Myxomycetes					1	13	13	3				
Stachybotrys					2	27	13	7	5	67	13	7
Stemphylium												
Torula												
Unidentified Conidia												
Notes:												

Prepared By:
CS Review:

Technical Review:
Final Review:

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Attn: Dr. David Anderson

AIHA Empat No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-4269
Project Name: WNY-176
Project Number: 0981
Date Received: 09/29/01
Date Reported: 10/01/01

Lab Number	4				5				6			
Sample Identification	0989 Outside Cont (C)				0885 Outside Cont 1994				0806 E Side 1910			
Volume (M^3)	0.0750				0.0750				0.0750			
Date Analyzed	09/30/2001				09/30/2001				09/30/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification				100% of Trace at 600X Magnification				100% of Trace at 600X Magnification			
Debris Rating	2				2				2			
		Count/M^3				Count/M^3				Count/M^3		
	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%
Mycelial Fragments	2	27	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Pollen Count	<1	<13	13	n/a	<1	<13	13	n/a	1	13	13	n/a
Total Fungal Spores	32	427	13	100	21	280	13	100	26	347	13	100
	Fungal Spore Identification				Fungal Spore Identification				Fungal Spore Identification			
Alternaria									1	13	13	4
Amerospores	23	307	13	72	19	253	13	90	18	240	13	69
Arthrinium												
Ascospores	2	27	13	6					2	27	13	8
Aspergillus/Penicillium	3	40	13	9	2	27	13	10	4	53	13	15
Aureobasidium												
Basidiospores												
Bipolaris/Dreschlera												
Botrytis												
Chaetomium												
Cladosporium	4	53	13	12					1	13	13	4
Curvularia												
Epicoccum												
Fusarium												
Nigrospora												
Oidium/Peronospora												
Pithomyces/Ulocladium												
Rusts												
Smuts/Myxomycetes												
Stachybotrys												
Stemphylium												
Torula												
Unidentified Conidia												
Notes:												

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AIHA Empat No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-4269
Project Name: WNY-176
Project Number: 0981
Date Received: 09/29/01
Date Reported: 10/01/01

Lab Number	7				8				9			
Sample Identification	0805 ZWNCIS				0863 2 Center				0892 2 E			
Volume (M^3)	0.0750				0.0750				0.0750			
Date Analyzed	09/30/2001				09/30/2001				09/30/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification				100% of Trace at 600X Magnification				100% of Trace at 600X Magnification			
Debris Rating	3				3				3			
	Total Count	Count/M^3 Result	Count/M^3 Detection Limit	%	Total Count	Count/M^3 Result	Count/M^3 Detection Limit	%	Total Count	Count/M^3 Result	Count/M^3 Detection Limit	%
Mycelial Fragments	1	13	13	n/a	4	53	13	n/a	1	13	13	n/a
Pollen Count	1	13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	27	360	13	100	38	507	13	100	36	480	13	100
	Fungal Spore Identification				Fungal Spore Identification				Fungal Spore Identification			
Alternaria					1	13	13	3				
Amerospores	24	320	13	89	20	267	13	53	23	307	13	64
Arthrinium									1	13	13	3
Ascospores					3	40	13	8	1	13	13	3
Aspergillus/Penicillium					14	187	13	37	10	133	13	28
Aureobasidium												
Basidiospores												
Bipolaris/Dreschlera												
Botrytis												
Chaetomium												
Cladosporium	3	40	13	11								
Curvularia												
Epicoccum												
Fusarium												
Nigrospora												
Oidium/Peronospora												
Pithomyces/Ulocladium									1	13	13	3
Rusts												
Smuts/Myxomycetes												
Stachybotrys												
Stemphylium												
Torula												
Unidentified Conidia												
Notes:												

Prepared By:
CS Review:

Technical Review:
Final Review:

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Keller, TX 76248
Attn: Dr. David Anderson

AIHA Emlap No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-4269
Project Name: WNY-176
Project Number: 0981
Date Received: 09/29/01
Date Reported: 10/01/01

Lab Number	10				11				12			
Sample Identification	0651 3 W				0717 3 C 317				0813 3 E 301			
Volume (M^3)	0.0750				0.0750				0.0750			
Date Analyzed	09/30/2001				09/30/2001				09/30/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification				100% of Trace at 600X Magnification				100% of Trace at 600X Magnification			
Debris Rating	2				3				2			
	Total Count	Count/M^3 Result	Count/M^3 Detection Limit	%	Total Count	Count/M^3 Result	Count/M^3 Detection Limit	%	Total Count	Count/M^3 Result	Count/M^3 Detection Limit	%
Mycelial Fragments	<1	<13	13	n/a	1	13	13	n/a	<1	<13	13	n/a
Pollen Count	<1	<13	13	n/a	<1	<13	13	n/a	<1	<13	13	n/a
Total Fungal Spores	18	240	13	100	22	293	13	100	17	227	13	100
	Fungal Spore Identification				Fungal Spore Identification				Fungal Spore Identification			
Alternaria												
Amerospores	17	227	13	94	22	293	13	100	16	213	13	94
Arthrinium												
Ascospores												
Aspergillus/Penicillium												
Aureobasidium												
Basidiospores	1	13	13	6					1	13	13	6
Bipolaris/Dreschlera												
Botrytis												
Chaetomium												
Cladosporium												
Curvularia												
Epicoccum												
Fusarium												
Nigrospora												
Oidium/Peronospora												
Pithomyces/Ulocladium												
Rusts												
Smuts/Myxomycetes												
Stachybotrys												
Stemphylium												
Torula												
Unidentified Conidia												
Notes:												

Prepared By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: Dr. David Anderson

AIHA Empat No. 102297

Air-O-Cell Cassette Analysis

Aerotech Method: A001

Lab Number: A-109-4269
Project Name: WNY-176
Project Number: 0981
Date Received: 09/29/01
Date Reported: 10/01/01

Lab Number	16				17			
Sample Identification	0891 Telcom 5 C				0859 Outside			
Volume (M^3)	0.0750				0.0750			
Date Analyzed	09/30/2001				09/30/2001			
Percent Of Trace Analyzed	100% of Trace at 600X Magnification				100% of Trace at 600X Magnification			
Debris Rating	1				3			
		Count/M^3				Count/M^3		
	Total Count	Result	Detection Limit	%	Total Count	Result	Detection Limit	%
Mycelial Fragments	2	27	13	n/a	15	200	13	n/a
Pollen Count	<1	<13	13	n/a	1	13	13	n/a
Total Fungal Spores	26	347	13	100	156	2,080	13	100
	Fungal Spore Identification				Fungal Spore Identification			
Alternaria					1	13	13	1
Amerospores	23	307	13	88	63	840	13	40
Arthrinium					2	27	13	1
Ascospores					22	293	13	14
Aspergillus/Penicillium					3	40	13	2
Aureobasidium								
Basidiospores					10	133	13	6
Bipolaris/Dreschlera					4	53	13	3
Botrytis								
Chaetomium								
Cladosporium	3	40	13	12	40	533	13	26
Curvularia								
Epicoccum								
Fusarium								
Nigrospora								
Oidium/Peronospora								
Pithomyces/Ulocladium								
Rusts								
Smuts/Myxomycetes					10	133	13	6
Stachybotrys								
Stemphylium								
Torula								
Unidentified Conidia					1	13	13	1
Notes:								

Prepared By:
CS Review:

Technical Review:
Final Review:

AESI
1112 Charleston Ct.
Keller, TX 76248
Attn: Dr. David Anderson

AIHA Empat No. 102297

Microscopic Screen and Fungi Identification

Aerotech Method: S001

Lab Number: A-109-4269
Project Name: WNY-176
Project Number: 0981
Date Received: 09/29/01
Date Reported: 10/01/01

Lab Number	**18**	**19**	**20**	**21**
Sample Identification	A Swab In Wall S Of Fire Pump	B Swab S. Of Door	C Swab N Of Door	D Swab E Wall Inside Fire Pump
Date Analyzed	09/30/2001	09/30/2001	09/30/2001	09/30/2001
	Results	**Results**	**Results**	**Results**
Mycelial Fragments	1-5%	None Detected	None Detected	5-25%
Fungal Spores	5-25%	5-25%	5-25%	25-75%
	Fungal Spore Identification	**Fungal Spore Identification**	**Fungal Spore Identification**	**Fungal Spore Identification**
Alternaria				
Amerospores			1-5%	
Arthrinium				
Ascospores				
Aspergillus/Penicillium		1-5%		5-25%
Aureobasidium				
Basidiospores				
Bipolaris/Dreschlera				
Botrytis				
Chaetomium				
Cladosporium				
Curvularia				
Epicoccum				
Fusarium				
Nigrospora				
Oidium/Peronospora				
Pithomyces/Ulocladium				
Rusts				
Smuts/Myxomycetes				
Stachybotrys	5-25%	5-25%	5-25%	25-75%
Stemphylium			1-5%	
Torula				
Unidentified Conidia				
Notes:				

Prepared By:
CS Review:

Technical Review:
Final Review:

AEROTECH LABORATORIES, INC.

Tuesday, September 11, 2001

Dr. David Anderson
AESI
1112 Charleston Ct.
Keller, TX 76248

Re: Aerotech Project Number A-109-0683

Dear Dr. David:

Aerotech is pleased to provide the enclosed report of analyses for samples submitted Friday, September 07, 2001. This cover letter and accompanying pages are an integral part of this report. All analyses are performed in our AIHA proficiency-tested laboratory under the FDA Good Laboratory Practice Guidelines and the parameters outlined in the most current version of the American Conference of Governmental Industrial Hygienists Bioaerosol Guidelines. The data generated in this report is based on the samples and accompanying information provided. Aerotech employees did not collect samples for this project, and may provide limited interpretation of this data as it relates to the overall investigation.

Quality Assurance

Aerotech is staffed by certified microbiologists, maintains a rigorous Quality Assurance program and participates in the American Industrial Hygiene Association's Environmental Microbiology Proficiency Testing Program. Our AIHA EMPAT Number is 102297. Aerotech is extremely proud of its excellent scoring in this program and will provide copies of our results upon request. They can also be downloaded from our web site at www.aerotechlabs.com. Below you will find additional information regarding the specific analyses requested for this project.

A001, A002, WC001

Air-O-Cell Cassette

The Air-O-Cell Cassette is a unique sampling device designed for the rapid collection and analysis of a wide range of airborne particles, including fungal spores. Samples are analyzed via light microscopy at 600X magnification, with the entire slide (100% of the sample) being analyzed. The results are reported as **total**, meaning they include both viable and non-viable fungal spores. Unfortunately, this technique does not allow for the differentiation between *Aspergillus* and *Penicillium* spores. Small (~1-3μ) spherical fungal spores that cannot be identified and may include *Aspergillus*, *Penicillium*, and *Trichoderma* and others are grouped together as *Amerospores*. Additionally it does not allow for cultivation or speciation of spores. Slides containing greater than 500 fungal spores are difficult to count accurately due to overcrowding and are therefore estimations. Similarly, excessive non-microbial particulates can mask the presence of fungal spores, thereby reducing counting accuracies. All slides are graded with the following debris scale for data qualification.

Debris Rating Scale

Non-Microbial Particulate Debris Rating	Description	Interpretation
0	No particles detected	No particulates in on slide. The absence of particulates could indicate improper sampling, as most air samples typically contain some particulates
1	Minimal non-microbial debris present.	Reported values are not affected by debris.
2	Up to 25% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 1.3 times higher than reported.
3	26% to 75% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 1.4 to 4 times higher than reported
4	76% to 90% of the slide occluded with non-microbial particulates.	Non-microbial particulates can mask the presence of fungal spores. As a result, actual values could be up to 4 to 10 times higher than reported.
5	Greater than 90% of the slide occluded with non-microbial particulates.	Quantification not possible. Resamples should be collected at shorter time interval, or other measures taken to reduce the collection of non-microbial debris.

B001, S001

Microscopic Screen

A microscopic screen is a rapid analytical technique for confirming the presence and identity of fungi on a surface. The results are expressed as a percentage range relative to the prevalence and concentration of fungi in the sample. Samples are analyzed via light microscopy at 600X magnification. The results are reported as **total**, meaning they include both viable and non-viable fungal spores. Unfortunately, this technique does not allow for the differentiation between *Aspergillus* and *Penicillium* spores. Small (~1-3µ) spherical fungal spores that cannot be identified and may include *Aspergillus*, *Penicillium*, and *Trichoderma* are grouped together as *Amerospores*. Additionally this analysis does not allow for cultivation or speciation of spores.

A003, A004, A005, A006, B002, B003, B004, B007, CC002, CC003, CC004, CC005, S002, S003, S004, S007 W001, W002, W003, W004

Culture Analyses for Fungi and Bacteria

Cultureable microorganisms are those that are viable when media is inoculated, and will grow on the selected media and at the selected temperature. This technique has certain limitations when analyzing for certain types of fungi, specifically *Stachybotrys*. Some reports indicate that the recovery efficiency of *Stachybotrys* spores can be as low as 10% when compared to total spore techniques.

The type of media and incubation temperature can vary depending on the scope of the survey. Isolates are identified to the service level requested. Typical analysis includes identification of most fungi to the genus level. *Aspergillus* and *Penicillium* species are differentiated based on morphology with each variant reported separately. Identification to the species level can be performed if requested in advance. General incubation parameters are summarized below. Incubation times can vary depending on specific growth characteristics. Samples submitted for culture analysis using Cornmeal Agar (CMA) or Cellulose Agar are cultured for 14 days.

Test	Incubation Temperature (° C)	Incubation Time
Environmental Bacteria	28	48 hours
Total Fungi	20-25	7-10 days
Thermophilic fungi	37	7-10 days
Thermophilic Actinomycetes	50	48 hours

Common Culture Media

Acronym	Name
BAP	Tryptic Soy Agar with 5% Sheep Blood
PCA	Plate Count Agar
R2A	R2A
BCYE	Buffered Charcoal Yeast Extract Agar
PDA	Potato Dextrose Agar
MEA	Malt Extract Agar
DG-18	Dichloran Glycerol Agar
SAB	Sabauroud's Dextrose Agar
RBA	Rose Bengal Agar
CYA	Czapeck's Yeast Agar

A010, A010.1, B013

Volatile Organic Compounds (VOC's)

Analysis for VOC's includes the EPA T015 method, utilizing a gas chromatograph (GC) coupled to a mass spectrometer (MS). This method includes quantification of 63 compounds. Tentatively identified compounds (TIC's) can also be identified and their concentrations estimated by performing a compound library search of over 100,000 compounds. Results are reported in parts per billion on a volume basis (ppbv).

For additional information, or if you have any questions regarding this report, please do not hesitate to call.

Sincerely,

Ruth Skinner
Project Manager
Aerotech Laboratories, Inc.
800-651-4802

Analytical References

1. Medically Important Fungi: A Guide to Identification, 3rd ed., ASM, 1995.
2. Standard Methods for the Examination of Water and Wastewater, 19th ed., APHA, 1995.
3. Sampling and Identifying Allergenic Pollens and Molds, Blewstone, 1990.
4. Identifying Filamentous Fungi: A Clinical Laboratory Handbook, Star, 1996.
5. Manual of Clinical Microbiology, 7th ed., ASM, 1999.
6. A Laboratory Guide to Common *Aspergillus* Species and their Teleomorphs, CSIRO, 1994.
7. Bioaerosols: Assessment and Control, ACGIH, 1999.

AEROTECH LABORATORIES, INC.

September 19, 2001

David Anderson
AESI
1112 Charleston Court
Keller, TX 76248
TEL: (817) 379-6968
FAX (817) 337-0615

RE: NYW/0880C (176) Order No.: 0109171

Dear David Anderson:

Precision Analytical Laboratories, Inc. received 1 sample on 9/7/2001 for the analyses presented in the following report.

This report includes the following information:
- Case Narrative.
- Analytical Report: includes test results, report limit (Limit), any applicable data qualifier (Qual), units, dilution factor (DF), and date analyzed.
- QC Summary Report.

Sincerely,

Ruth Skinner
Project Manager

CC:

2020 West Lone Cactus Drive • Phoenix, Arizona 85027 • 623 780-4800 • 1-800-651-4802 • Fax 623 780-7695 • www.aerotechlabs.com

CLIENT: AESI
Project: NYW/0880C (176)
Lab Order: 0109171

CASE NARRATIVE

Data Qualifiers:

Listed below are data qualifiers which may be used in your analytical report to explain any analytical or quality control issues. If one or more of the following data qualifiers is associated with your analytical or quality control data it will be noted in your report under the column header "QUAL". Any quality control deficiencies that cannot be adequately described by these qualifiers will be addressed in the analytical comments section of this case narrative.

R4 RPD exceeded the method control limit. Recovery met acceptance criteria.

All analyses included in this report were performed by Precision Analytical Laboratories, Inc. (PAL), 1725 W. 17th Street, Tempe, Arizona (ADHS certification no. AZ0610, California 2410).

PAL participates in the AIHA Proficiency Analytical Testing (PAT) program for metals, solvents, and formaldehyde.

Samples were analyzed using methods outlined in references such as:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition.

NIOSH Manual of Analytical Methods, Fourth Edition, 1994. NIOSH Method 7300 analyses are performed using a modified digestion procedure to eliminate the use of perchloric acid. NIOSH Methods 1501 and 1003 are modified to incorporate the use of a mass spectrometer detector instead of FID.

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, 1999.

Analytical Comments:

All method blanks and laboratory control spikes met EPA method and/or laboratory quality control objectives for the analyses included in this report.

Sample results have not been corrected for blank values.

If any additional non-target peaks were found for the Method TO-15 analysis, the number of non-target peaks found and the approximate concentration range will be included at the end of the analytical report, designated with a "T" qualifier. If requested, the laboratory can perform a forward library search for the non-target peaks found to provide additional information about the chemical composition and

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estimated concentration of the additional peaks. Please contact your project manager for more information.

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Appendix C

Fungal Glossary

FUNGAL GLOSSARY

Acremonium sp. (Cephalosporium sp.) - Reported to be allergenic. Can produce a trichothecene toxin that is toxic if ingested. It was the primary fungus identified in at least two houses where the occupant complaints were nausea, vomiting and diarrhea. The asexual state of *Emericellopsis sp., Chaetomium sp.*, and *Nectripsis sp.*, it can produce mycetomas, infections of the cornea and nails.

Alternaria sp. - Conidia dimensions 18-83 x 7-18 microns. A very common allergen with an IgE mediated response. It is often found in carpets, textiles, and on horizontal surfaces in building interiors. Often found on window frames. Outdoors it may be isolated from samples of soil, seeds and plants. It is commonly found in outdoor samples. The large spore size 20 - 200 microns in length and 7 - 18 microns in sizes, suggests that the spores from this fungi will deposited in the nose, mouth and upper respiratory tract. It may be related to "Baker's Asthma." It has been associated with hypersensitivity pneumonitis. The species *Alternaria alternata* is capable of producing tenuazonic acid and other toxic metabolites, which may be associated with disease in humans or animals. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms; chronic cases may develop pulmonary emphysema.

Aspergillus flavus - Conidia dimensions 3-6 microns. It grows on moldy corn and peanuts. It can be found in warm soil, foods and dairy products. Some strains are capable of producing a group of mycotoxins - in the aflatoxin group. Aflatoxins are known animal carcinogen. There is limited evidence to suggest that this toxin is a human carcinogen. The toxin is a poisonous to humans by ingestion. It may also result in occupational disease via inhalation. Experiments have indicated that it is teratogenic and mutagenic. It is toxic to the liver. It is reported to be allergenic. Its presence is associated with reports of asthma. It can be found in water-damaged carpets. The production of the fungal toxin is dependent on the growth conditions and on the substrate used as a food source. This fungus is associated with aspergillosis of the lungs and/or disseminated aspergillosis. This fungus is occasionally identified as the cause of corneal, otomycotic and nasoorbital infections.

Aspergillus fumigatus - Conidia dimensions 2-3.5 microns. Major cause of aspergillosis. This organism causes both invasive and allergic aspergillosis. Aspergillosis affects individuals who are immune compromised. It is considered a human pathogen. It grows well at 35 ^{0} C. It is commonly found outdoors in compost piles with temperatures higher than 40 ^{0} C, in mild to warm soils and on cereals.

Aspergillus nidulans - Conidia dimensions 2-4 microns. Found in mild to warm soils and on slowly decaying plants. Can produce the mycotoxin sterigmatocystin. This toxin has been shown to produce liver and kidney damage in lab animals. This fungus is associated with aspergillosis of the lungs and/or disseminated aspergillosis. This species is only occasionally pathogenic.

Aspergillus niger - Conidia dimensions 3.5 - 5 microns or 4 to 5 microns. Less common cause of aspergillosis. It has a musty odor. It is commonly found in the environment on textiles, in soils, grains, fruits and vegetables. It has been reported to cause skin and pulmonary infections. It is a common cause of fungal related ear infections-otomycosis.

Aspergillus sp. - Reported to be allergenic. Members of this genus are reported to cause ear infections. Many species produce mycotoxins, which may be associated with disease in humans and other animals. Toxin production is dependent on the species or a strain within a species and on the food source for the fungus. Some of these toxins have been found to be carcinogenic in animal species. Several toxins are considered potential human carcinogens. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms; chronic cases may develop pulmonary emphysema.

Aspergillus versicolor -Conidia dimensions 2-3.5 microns. It is commonly found in soil, hay, cotton and dairy products, it can produce a mycotoxin sterigmatocystin and cyclopiaxonic acid. These toxins can cause diarrhea and upset stomach. It is reported to be a kidney and liver carcinogen. This species is only occasionally pathogenic.

Basidiomycetes - Fungal spores that are from mushrooms. The specific mushroom species cannot be identified on the culture plate. Many mushroom spores are reported to be allergenic.

Bipolaris sp. - A fungus with large spores that would be expected to be deposited in the upper respiratory tract. This fungus can produce the mycotoxin - sterigmatocystin that has been shown to produce liver and kidney damage when ingested by laboratory animals.

Blastomyces sp. - Human pathogen. The fungus is commonly found in soil. It is a dimorphic fungus, which has filamentous fungus when grown at 25 $^{\circ}$ C, and a yeast form at 37 $^{\circ}$ C.

Botrytis sp. - Conidia dimensions 7-14 x 5-9 microns. Found in soil and vegetables. Possibly associated with allergic symptoms (skin tests)

Chaetomium sp. - Large ascomycetous fungus producing perithecia. It is found on a variety of substrates containing cellulose including paper and plant compost. It has been found on paper in sheetrock. It is reported to be allergenic. Can produce an *Acremonium*-like state on fungal media.

Cladosporium sp. (Hormodendrum sp.) - Most commonly identified outdoor fungus. The outdoor numbers are reduced in the winter. The numbers are often high in the summer. Often found indoors in numbers less than outdoor numbers. It is a common allergen. Indoor Cladosporium sp. may be different than the species identified outdoors. It is commonly found on the surface of fiberglass duct liner in the interior of supply ducts. A wide variety of plants are food sources for this fungus. It is found on dead plants, woody plants, food, straw, soil, paint and textiles. It can cause mycosis. Produces greater than 10 antigens. Antigens in commercial extracts are of variable quality and may degrade within weeks of preparation. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms; chronic cases may develop pulmonary emphysema.

Cunninghamella sp. - Can cause disseminated and pulmonary infections in immune compromised hosts.

Curvularia sp. - Reported to be allergenic. It may cause corneal infections, mycetoma and infections in immune compromised hosts.

Dreschlera sp. - Conidia dimensions 40-120 x 17-28 microns. Found on grasses, grains and decaying food. It can occasionally cause a corneal infection of the eye.

Epicoccum sp. - Conidia dimensions 15-25 microns. A common allergen, it is found in plants, soil, grains, textiles and paper products.

Fusarium sp. - A common soil fungus. It is found on a wide range of plants. It is often found in humidifiers. Several species in this genus can produce potent trichothecene toxins. The trichothecene (scirpene) toxin targets, the following systems: circulatory, alimentary, skin and nervous. Produces vomitoxin on grains during unusually damp growing conditions. Symptoms may occur either through ingestion of contaminated grains or possibly inhalation of spores. The genera can produce hemorrhagic syndrome in humans (alimentary toxic aleukia). Nausea, vomiting, diarrhea, dermatitis, and extensive internal bleeding characterize this. Reported to be allergenic. Frequently involved in eye, skin and nail infections.

Geotrichum sp. - Conidia dimensions 6-12 x 3-6 microns. A common contaminant of grains, fruits, dairy products, paper, textiles, soil and water, and often present as part of the normal human flora. The species *Geotrichum candidum* can cause a secondary infection (geotrichosis) in association with tuberculosis. This rare disease can cause lesions of the skin, bronchi, mouth, lung and intestine.

Gliocladium sp. - A fungus, which is structurally similar to *Penicillium sp*. It is reported to be allergenic.

Monilia sp. - Reported to be allergenic. This fungus produces soft rot of tree fruits. Other members produce a red bread mold. It is infrequently involved in corneal eye infections.

Mucor sp. - Often found in soil, dead plant material, horse dung, fruits and fruit juice. It is also found in leather, meat, dairy products, animal hair and jute. A *Zygomycetes* fungus that may be allergenic (skin and bronchial tests). This organism and other *Zygomycetes* will grow rapidly on most fungal media. May cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus, brain, eye and skin. Infection may have multiple sites.

Paecilomyces sp. - Commonly found in soil and dust, less frequently in air. *P. variotii* can cause paecilomycosis. Linked to wood-trimmers disease and humidifier associated illnesses. They are reported to allergenic. Some members of this genus are reported to cause pneumonia. It may produce arsine gas if growing on arsenic substrate, which can occur on wallpapers covered with Paris green.

Penicillium sp. - A wide number of organisms have been placed in this genus. Identification to species is difficult. Often found in aerosol samples. Commonly found in soil, food, cellulose and grains. It is also found in paint and compost piles. It may cause hypersensitivity pneumonitis, allergic alveolitis in susceptible individuals. It is reported to be allergenic (skin). It is commonly found in carpet, wallpaper, and in interior fiberglass duct insulation. Some species can produce mycotoxins. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchiospasms; chronic cases may develop pulmonary emphysema.

Phoma sp. - A common indoor air allergen. It is similar to the early stages of growth of *Chaetomium sp*. The species are isolated from soil and associated plants (particularly potatoes). Produces pink and purple spots on painted walls. It may have antigens that cross-react with those of *Alternaria sp*. It will grow on butter, paint cement and rubber. It may cause phaeohyphomycosis a systematic or subcutaneous disease.

Rhizomucor sp. - The *Zygomycetous* fungus is reported to be allergenic. It may cause mucorosis in immune compromised individuals. It occupies a biological niche similar to *Mucor sp.* It is often linked to occupational allergy. May cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus, brain, eye and skin. Infection may have multiple sites.

Rhizopus sp. - The *Zygomycetous* fungus is reported to be allergenic. It may cause mucorosis in immune compromised individuals. It occupies a biological niche similar to *Mucor sp.* It is often linked to occupational allergy. May cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus, brain, eye and skin. Infection may have multiple sites.

Sporotrichum sp. - Reported to be allergenic. See also *Sporothrix* sp. there is some taxonomic confusion between these two genera. This genera does not cause sporotrichosis.

Stachybotrys sp. - Several strains of this fungus (*S. atra*, S. *chartarum* and S. *alternans* are synonymous) may produce a trichothecene mycotoxin- Satratoxin H - which is a poisonous by inhalation. The toxins are present on the fungal spores. This is a slow growing fungus on media. It does not compete well with other rapidly growing fungi. The dark colored fungi grows on building material with high cellulose content and low nitrogen content. Areas with relative humilities above 55% and are subject to temperature fluctuations are ideal for toxin production.

Individuals with chronic exposure to the toxin produced by this fungus reported cold and flu symptoms, sore throats, diarrhea, headaches, fatigue, dermatitis, intermittent local hair loss and generalized malaise. The toxins produced by this fungus will suppress the immune system affecting the lymphoid tissue and the bone marrow. Animals injected with the toxin from this fungus exhibited the following symptoms, necrosis and hemorrhage within the brain, thymus, spleen, intestine, lung, heart, lymph node, liver, and kidney. Affects by absorption of the toxin in the human lung are known as pneumomycosis.

This organism is rarely found in outdoor samples. It is usually difficult to find in indoor air samples unless it is physically disturbed or if there is (speculation- a drop in the relative humidity). The spores are in a gelatinous mass. Appropriate media for the growth of this organism will have high cellulose content and low nitrogen content. The spores will die readily after release. The dead spores are still allergenic and toxigenic. Percutaneous absorption has caused mild symptoms.

Stemphylium sp. - Reported to be allergenic. Isolated from dead plants and cellulose materials.

Trichoderma sp. - It is commonly found in soil, dead trees, pine needles, paper, and unglazed ceramics. It often will grow on other fungi. It produces antibiotics that are toxic to humans. It has been reported to be allergenic. It readily degrades cellulose.

Trichothecium sp. - Conidia dimensions 12-23 x 8-10 microns. Found in decomposing vegetation, soil, corn seeds and in flour. The species *Trichothecium roseum* can produce a trichothecene toxin that may be associated with disease in humans and other animals. Reported to be allergenic.

Ulocladium sp. - Isolated from dead plants and cellulose materials. Found on textiles.

Yeast - Various yeasts are commonly identified on air samples. Some yeasts are reported to be allergenic. They may cause problems if a person has had previous exposure and developed hypersensitivity's. Yeasts may be allergenic to susceptible individuals when present in sufficient concentrations.

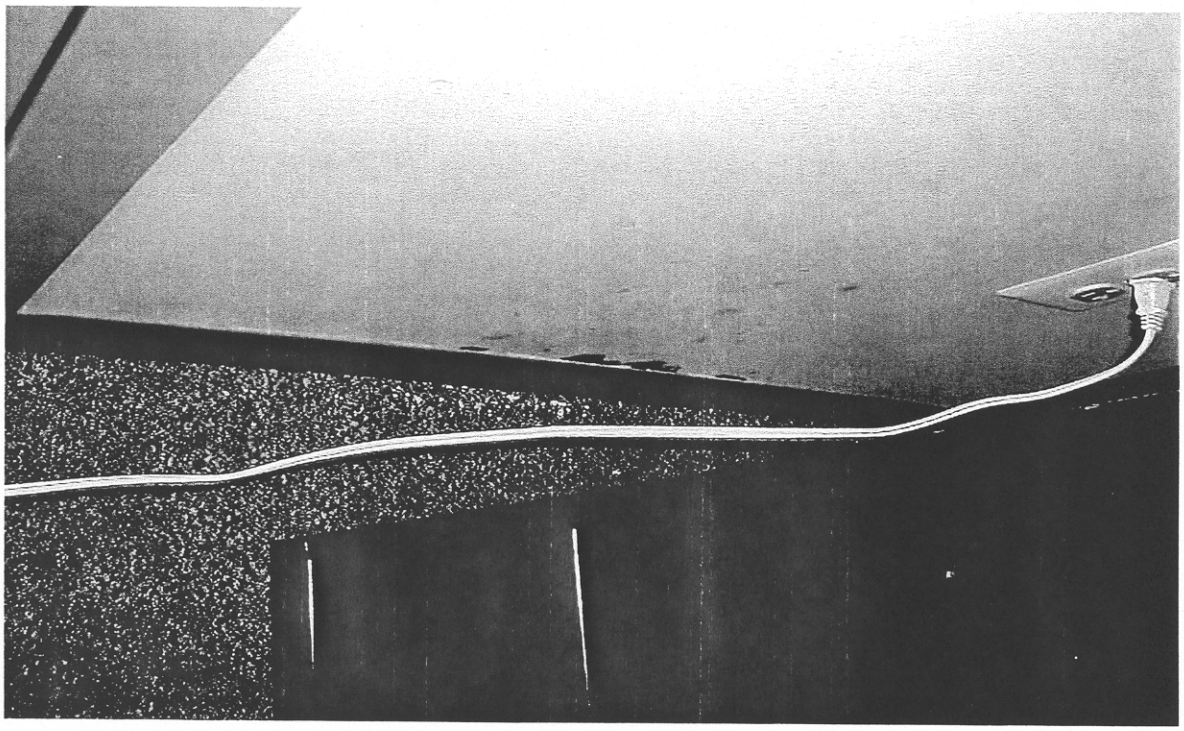
(Adapted from University of Minnesota, © 12/00 AESI)

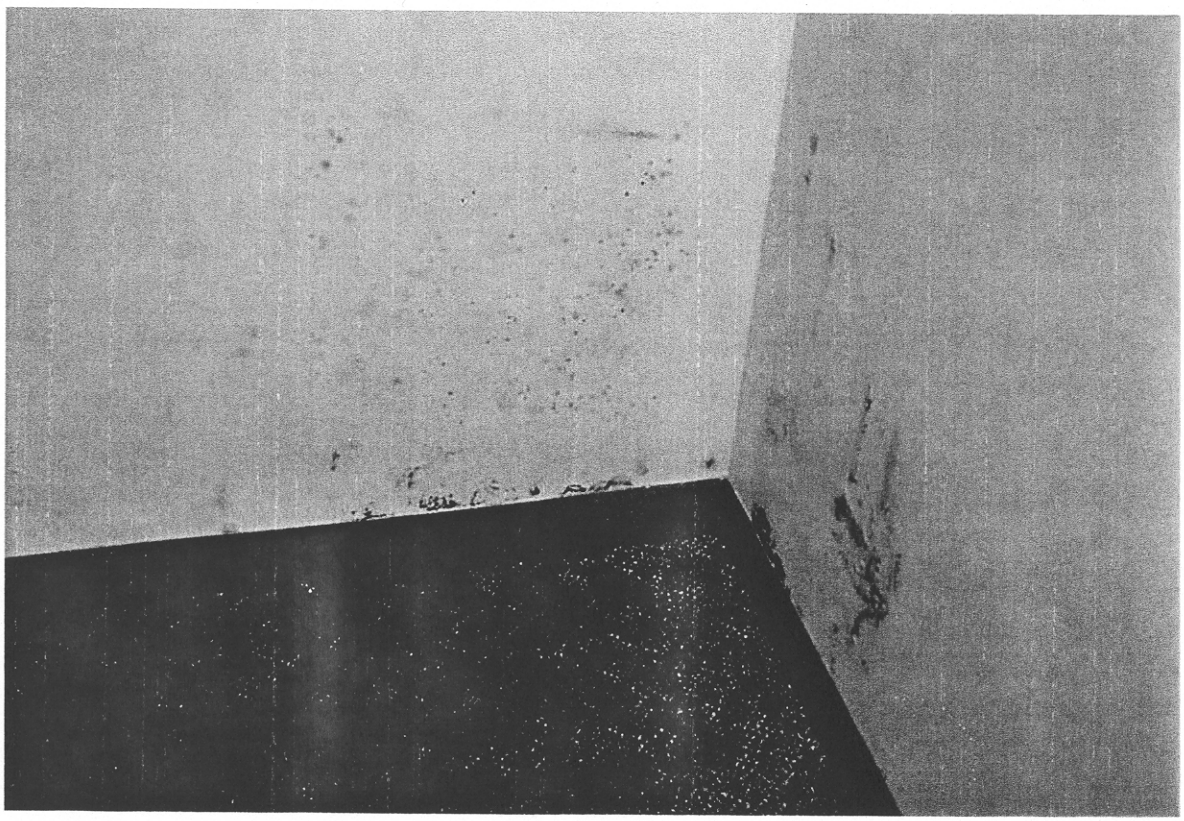
0983 A & B

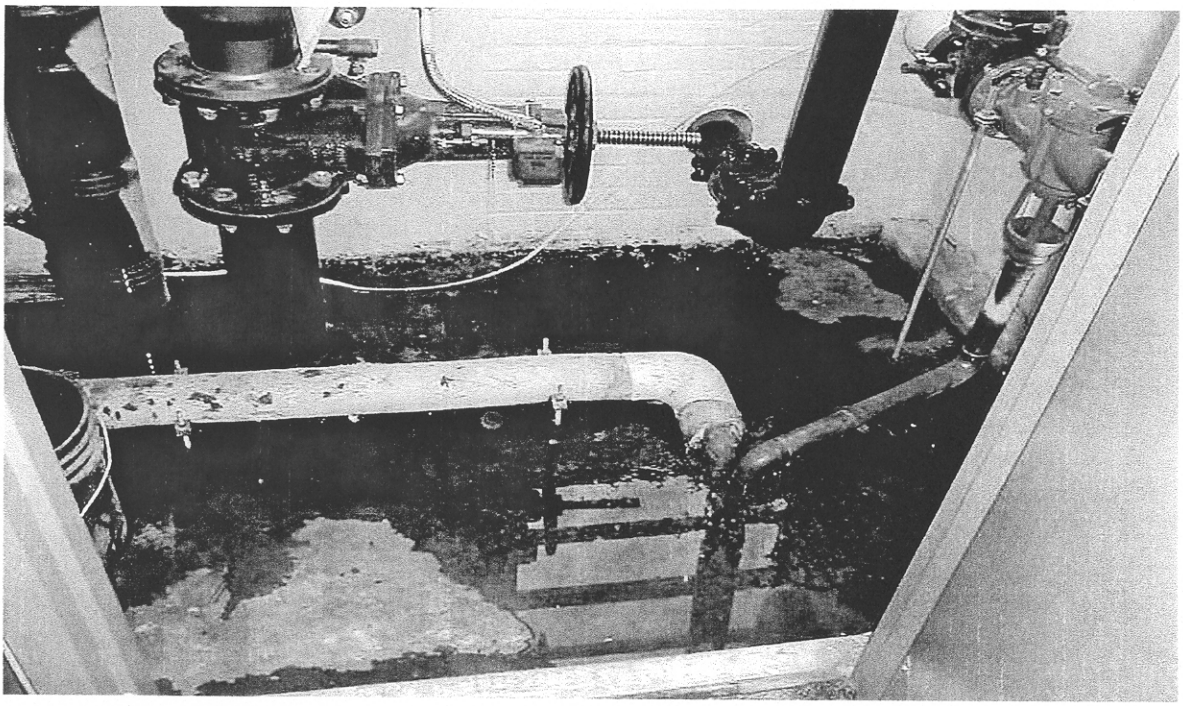
Appendix D

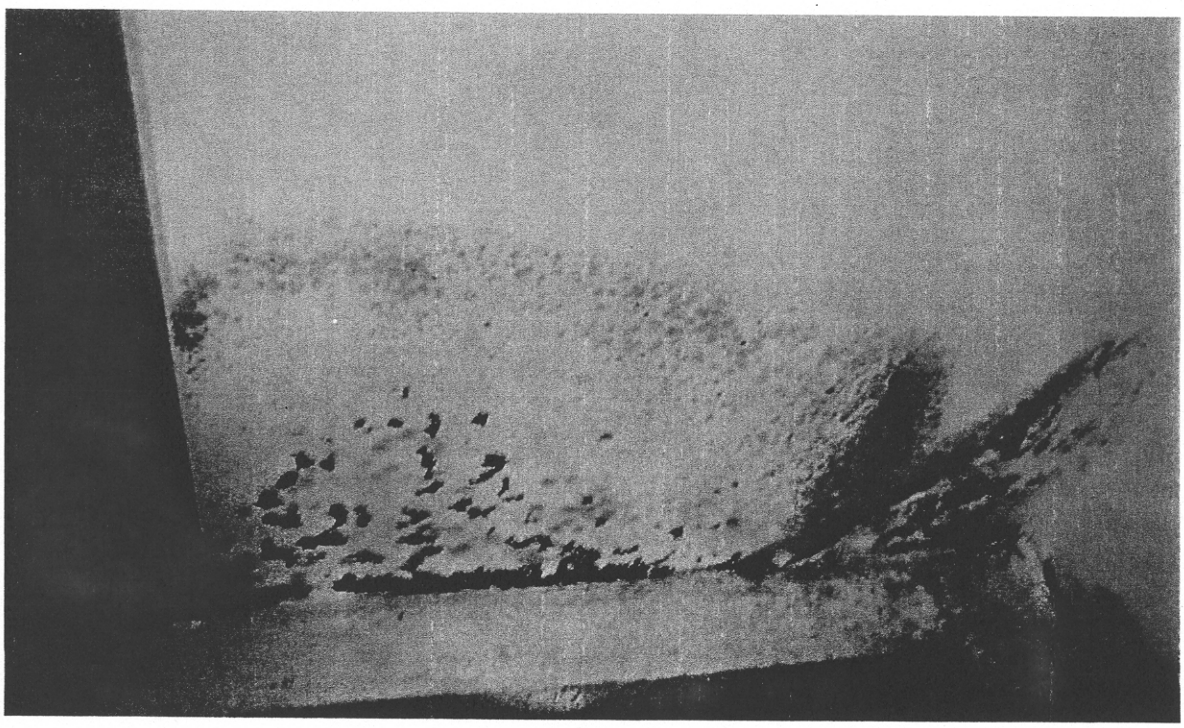
Selected Photographs

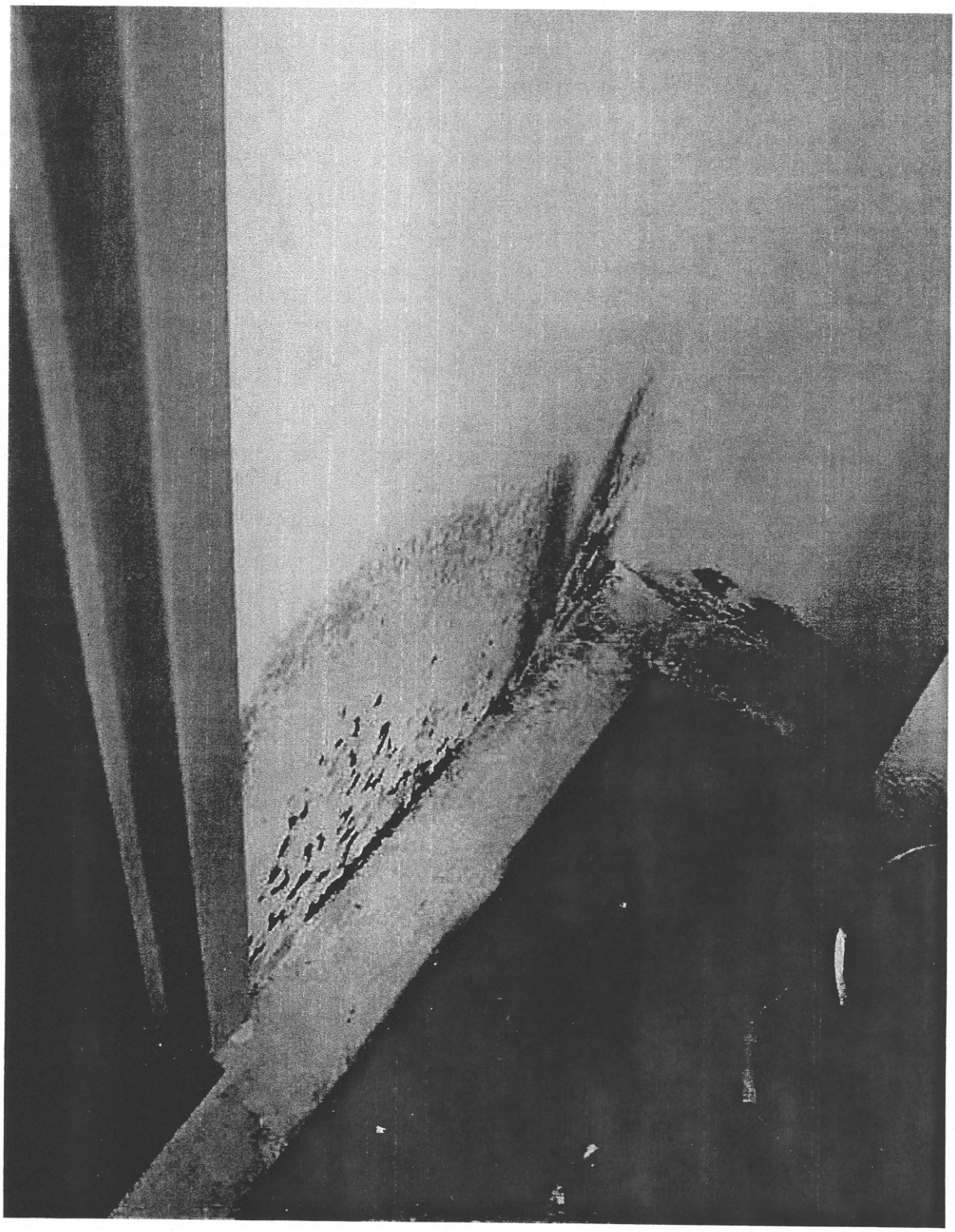
September 5, 2001



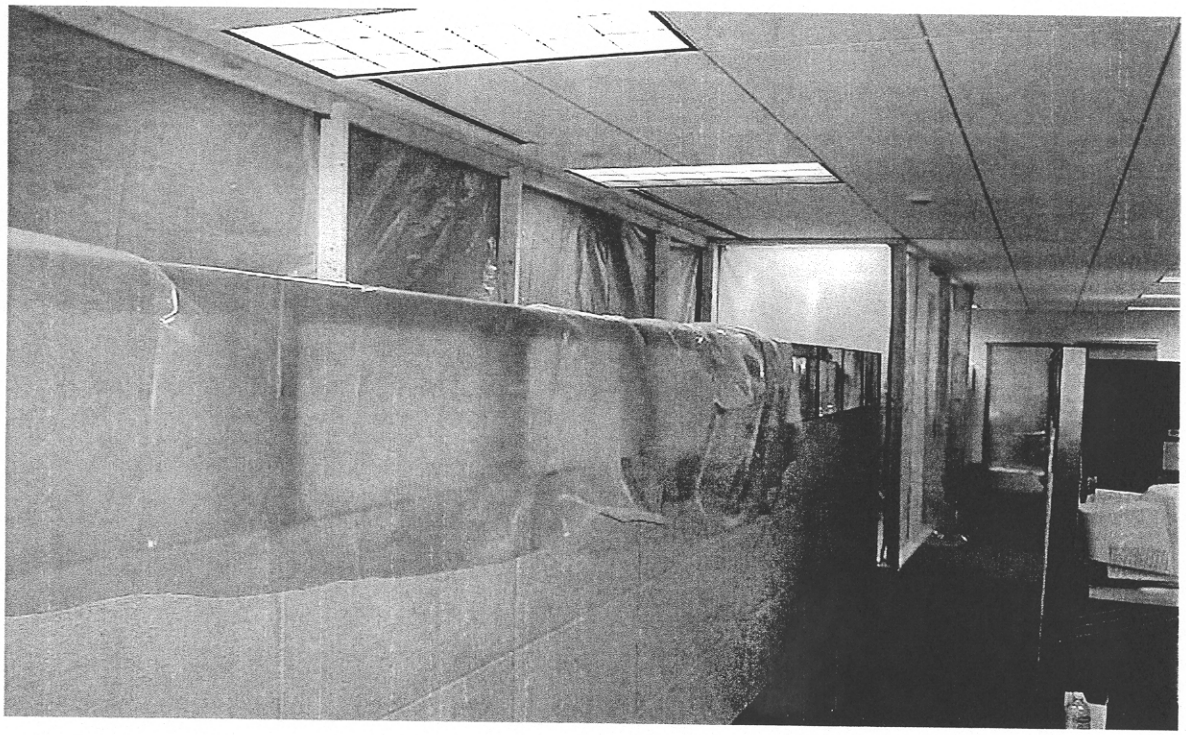


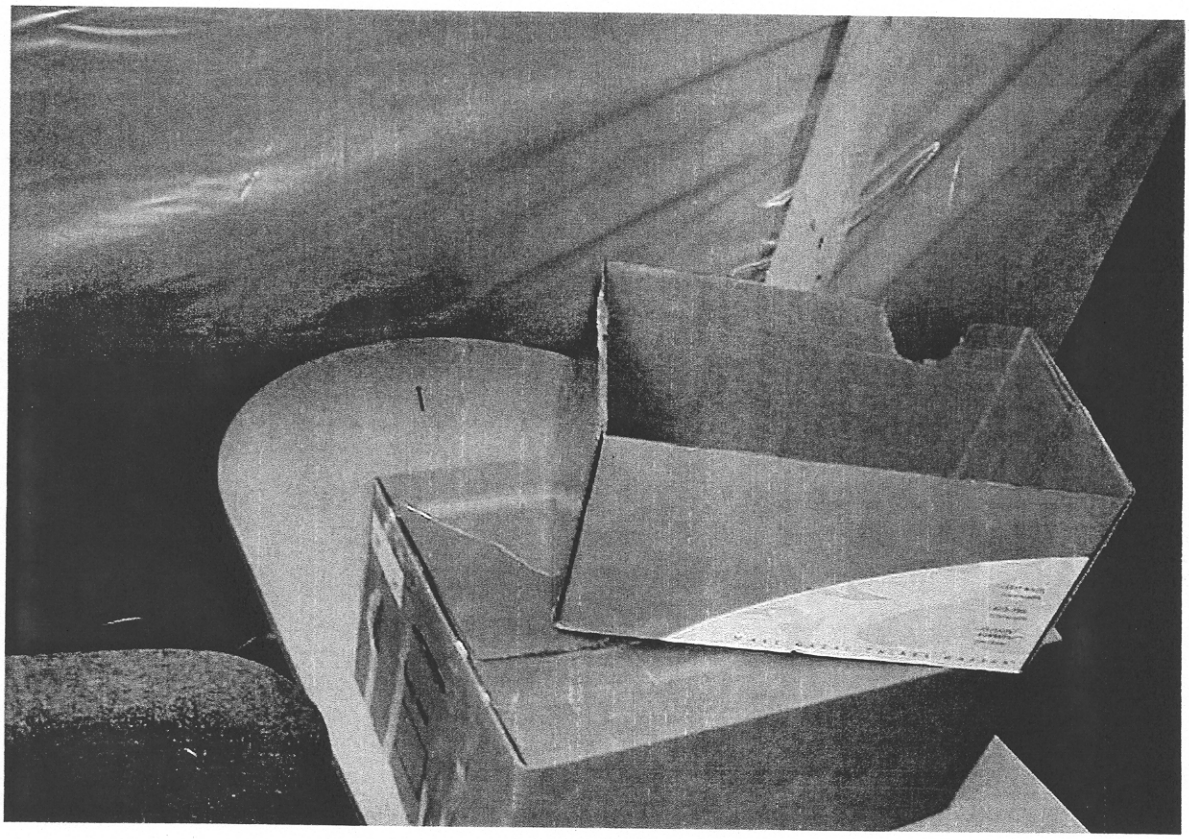


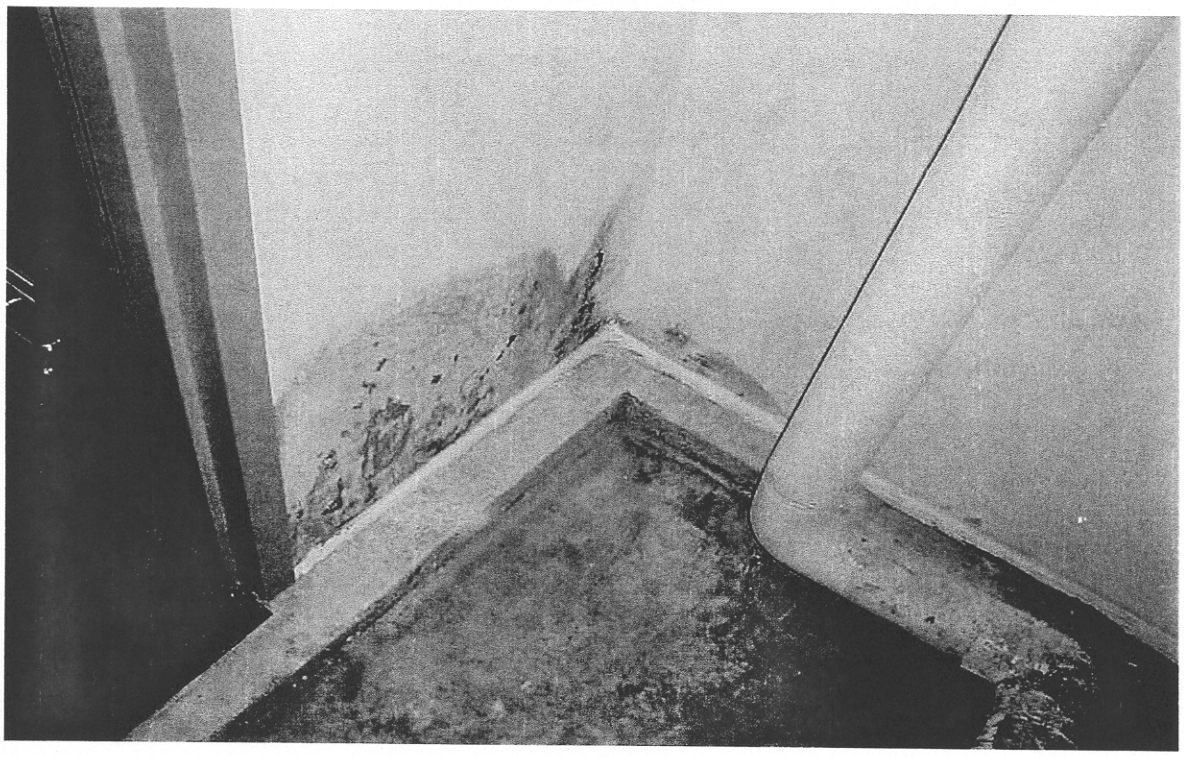


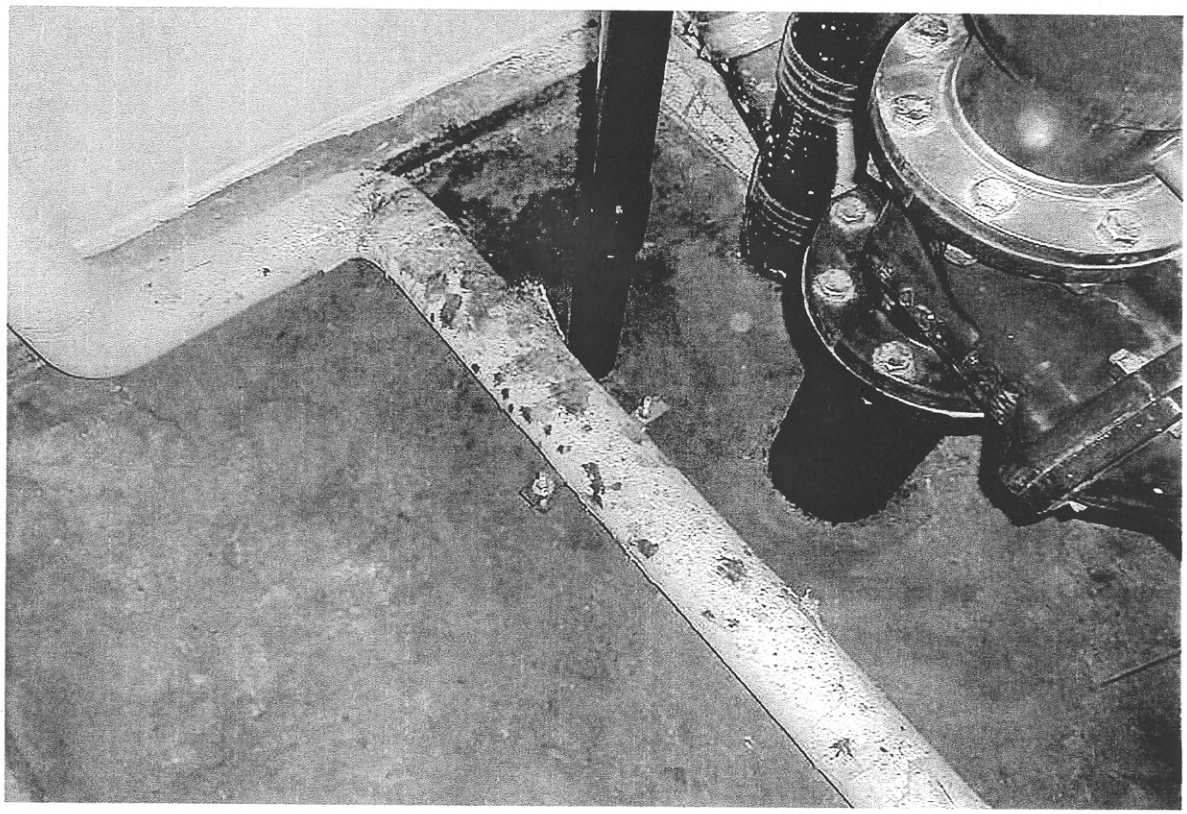


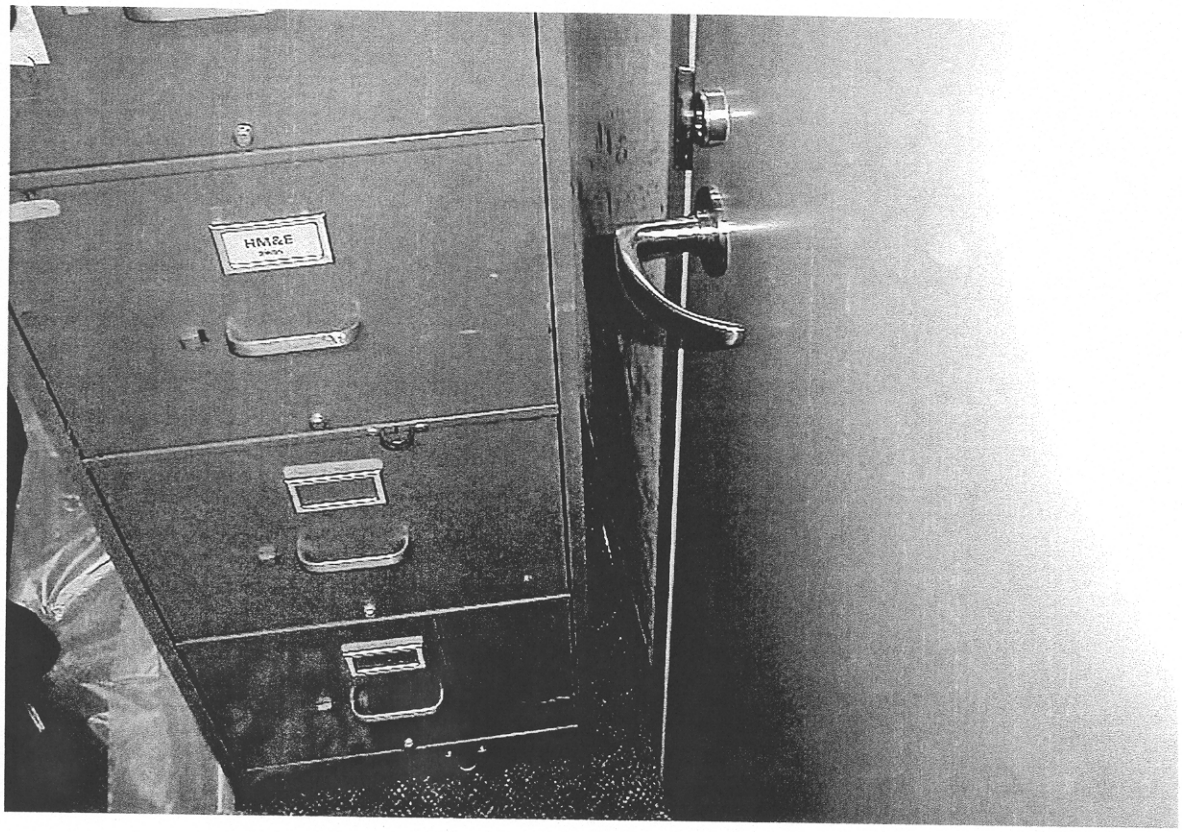
September 27, 2001







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